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REPORT ON THE FIELD EXPERIMENTS, KUALA KANGSAR, 1912-13.

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These Experiments were instituted in June 1912 for the purpose of studying padi cultivation, of obtaining accurate data concerning different varieties of padi and as a basis for seed selection.

The work has been carried out on aplot of ground situated at Talang, Kuala Kangsar, the property of H. H. the Sultan of Perak. It had been abandoned for some years and was covered with a rank growth of bluka and coarse grasses. The plot was selected on account of the evenness of texture of its soil and its abandonment by the natives with whom it had yielded an average of about 350 gantangs per acre.

The first season's crop has now been harvested and the following results obtained :—

No.	Variety.	Growing Period	Height	Average Tillering Power	No. of grain in a single ear	Yield per plot	Yield per acre	Remarks.
		months	feet			gantangs	gantangs	
1	Kao Sain Dieu	4	3	11	90	3.75	**75**	
2	Mayang Bawang	8	4	14	350	29	**580**	(badly attacked by grain moth)
3	Byra	4	3	13	120	7.25	**145**	
4	Thong Raja	4	3	12	210	14.25	**285**	
5	Haladi Sanna	4½	4	16	310	19	**380**	
6	Chanti	9	4½	12	330	28	**560**	
7	Bunga Sena	6½	5	15	370	21.5	**430**	
8	Aravadanalla Sambha	3	2½	13	—	—	—	(all eaten by rats after flowering)
9	Kao Loeng Loy	5	3	10	140	4.75	**95**	

No.	Variety.	Growing Period	Height	Average Tilering Power	No. of grain in a single ear	Yield per plot	Yield pea acre	Remarks.
		months	feet			gantangs.	gantangs.	
10	Meja Ringam	8	5½	13	240	35	**700**	
11	Seroup	8½	4½	13	270	33	**660**	(attacked by grain moth)
12	Doddabile	4	3½	12	400	2½	**50**	
13	Kao	4	3	11	150	19	**380**	
14	Kao Bang	4	3	12	210	9.5	**190**	
15	Redang Petani	7	4½	10	360	22	**440**	(attacked by grain moth)
16	Kranji	9		11	260	28.5	**570**	
17	Bangarasarapani	4	3		105	2.5	**50**	(nearly all eaten by birds before maturity)
18	Serendah	9		14	110	26	**520**	
19	Gintang Kechil	6	3	9		15.5	**310**	
20	Pahit (K.K.)	8	4½	30		33	**660**	(a portion of this plot destroyed by ulat)
21	Japanese	2	1½	10	70	2.5	**50**	
22	Kao Sien	5	4		136	6	**120**	
23	Pahit (Krian)	8	5¼	33		24	**480**	(a portion of this plot destroyed of ulat)
24	Radin	7	4½	24	324	31	**610**	
25	Santap	7	3	12	240	7.25	**145**	(a hill padi of superior flavour)
26	Kao Loeng Bao	4	3	8	90	4.75	**98**	
27	Snyadi	7	5	13	465	19	**380**	
28	Pandan Lembut	7	4	16	250	24	**480**	(attacked by grain moth)
29	Anak Ikan	7	5	15	310	22.75	**455**	
30	Padi Puteh	8	5¼	14	450	27.5	**550**	
31	Gulama	7	5	12	250	28.5	**565**	(attacked by grain (moth
32	Gintang bsar	8	5	11	230	24	**480**	
33	Siam (2)	8	4½		220	31	**610**	

Method of Cultivation.

The land was first 'tajah-ed' and the cut herbage left to dry 'in situ.' Two days afterwards it was 'chankolled' and the soil exposed to the air in the form of large clods. The dead weeds were worked underneath the clods of earth, the coolies using their feet for the purpose. After being exposed to the drying of the tropical sun for about a fortnight, the bindangs were flooded with water just sufficient to cover the clods of earth. The soil was then ploughed and thoroughly worked into the consistency of a thick puddle by means of a spiked roller or "bajak," when it was considered suitably prepared for the planting of the seedlings. Further supplies of water were withheld for a period of 10 days in order that the seedlings might become established in their new quarters.

This method of procedure did not meet with the entire approval of the Malays who prefer to carry out all their operations under water. They cut the weeds under water and then plough them into the puddle, any weeds remaining on the surface being trampled in either by their own feet or those of the buffaloes, which are made to walk up and down for the purpose. They maintain that the weeds are destroyed by burying them in the puddle, but as the flora of the bindangs consists to a large extent of hydrophytic plants the author was not convinced, hence the above departure from native custom.

For purposes of comparison of the two methods of cultivation the natives were allowed to cultivate an adjacent plot of ground after their own fashion, in which duplicate and triplicate plots of the above varieties were planted. The yields of these plots are given together with those of the first series in the following table :—

		Native Cultivation		
No.	Variety.	Duplicate	* Triplicate	Standard plot
34	Mayang Bawang	420		**580**
35	Thong Raja	45		**285**
36	Chanti	525		**580**
37	Bunga Sena	405	290	**430**
38	Meja Ringam	380		**700**
39	Seroup	455	360	**660**
40	Redang Petani	480	240	**440**
41	Keranji	430		**570**
42	Gintang Kechil	85		**310**
43	Pahit	480	420	**660**
44	Snyadi	295	260	**380**
45	Pandan Lembut	95		**480**
46	Anak Ikan	380		**455**
47	Padi puteh	390	320	**550**
48	Gintang besar	285		**480**
49	Siam 2	360	300	**610**

* These plots are situated on land slightly lower than that of the duplicate plots and were wetter and more suitable to the Malays than the latter.

The blanks in this column are due to the shortage of seedlings to plant up Triplicate plots.

The differences in the yields of the varieties grown according to the two systems of cultivation are shown more clearly in the form of a graph, in which the yields are respresented as ordinates.

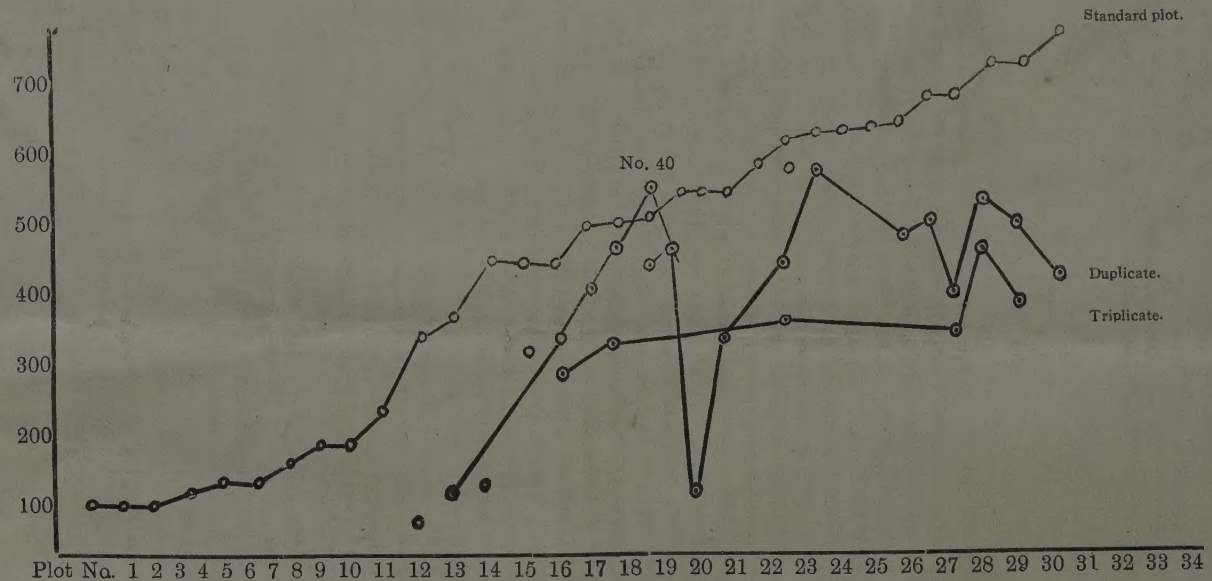
Observations and Conclusions.

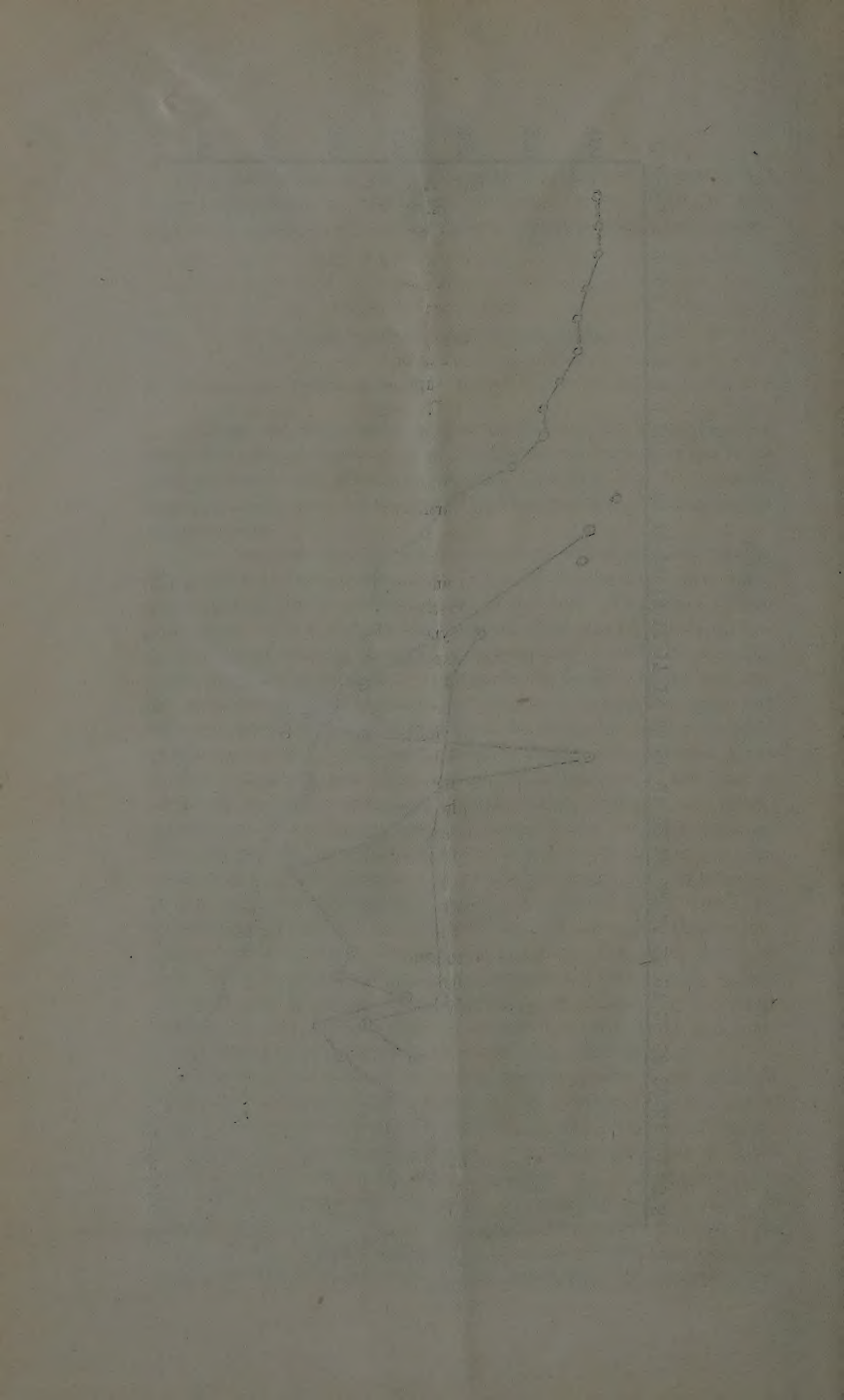
1. Concerning Cultivation.

Whilst the superiority of the preliminary dry ploughing over the native method is proved in this particular instance, it is not to be assumed that it will always be the case. Variety No. 40, Redang petani, actually gave a higher yield in the duplicate plot than in the standard plot.

The improvement in the growth of the standard plots may be due to either or both of two causes, *viz.*—(*a*) the destruction of water weeds and (*b*) the increased fertility of the soil. The effect of the cultivation on the flora of the standard plots was obviously an important factor because these plots required about half the weeding of the other series of plots. As regards the fertility of the soil, the dry cultivation would undoubtedly improve it in a certain sense but it cannot be concluded that this would be altogether in the interests of the rice plant. It has been shown in Japan and confirmed since in India that the rice plant assimilates its nitrogen in the form of ammonia and the ammoniacal decomposition products of organic matter, and that it has no use for nitrogen in the form of nitrates. Now the effect of exposing soil to the action of the air is to promote nitrification or the oxidation of ammonium compounds to nitrates, so that as far as the element nitrogen is concerned there would be a reduction in the fertility of the soil by this method of cultivation. There remains however, the action of the air on the other essential elements of plant nutrition, the phosphates and the potash. They are no doubt rendered more available for assimilation by the plant but how far this action of the air compares with that of the puddling process of the natives has not yet been ascertained.

It is very probable that a soil puddle is the most effective medium for producing fertility suitable to the needs of the rice plant. The conditions are eminently favourable for the ammoniacal decomposition of organic matter and also for denitrification, so that no nitrogen would exist in the form of nitrates. In fact, this supposition is supported by observations on the comparative sliminess or liability to form a puddle, of the soils in various padi districts. At Tanah Merah nr. Kuala Kangsar, at Rembau and Malacca, there are certain bindangs which have a local reputation for producing ex-


Standard plot.
No. 40
Duplicate.
Triplicate.
700
600
500
400
300
200
100
Plot No. 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34



cellent crops of 600 gantangs per acre year after year. In all these districts visited by the writer the soil exists in a state of soft velvety puddle to a depth of 2 feet or more, so that it is impossible to use a buffalo to prepare the land, and the only treatment these lands receive is a trampling in of the weeds after being cut with the tajah. Thus, with a minimum expenditure of labour these fields yield excellent crops of padi, and as the rent is the same as that of the poor land these holdings are never short of occupiers.

It is also an interesting fact in support of the above theory, that the soil analyses carried out by Mr. Barrowcliff, the Assistant Agricultural Chemist, show that the Tanah Merah soil actually contains less plant food than the soil of the poorer land of the experimental plots at Talang, Kuala Kangsar. Thus proving that the condition of the soil exerts a greater influence on fertility than chemical composition. Therefore the question that remains to be solved is 'what is the best method of producing this condition of soil fertility.'

Where shall we turn for an answer to this question? Is it to be found already existing in the instincts of that type of man whom every one recognises as the true type of the successful farmer, or is to be obtained as the result of experiment and research? If we look at the history of Agricultural progress in the West, what does agricultural practice as distinct from science owe to scientific research? Why do we not obtain yields of wheat comparab'e to the almost fabulous yields of ancient Babylon as described by Herodotus or even those more reasonable figures of Jethro Tull obtained in comparatively recent times by his system of husbandry? These methods of cultivation have been described and are known to science but they were not the result of scientific research but rather the results of instinctive experiment in the right direction. It may be that there exists somewhere a native padi planter who possesses the instinctive knowledge which is the answer to our question. At any rate it would seem desirable to study native methods in various districts in the hope of finding the embodiment of the true farming instinct rather than to rely entirely on experimental research in this direction.

2. Concerning the native plough.

This is a much maligned implement and held responsible by many people for the unsatisfactory padi crops. This is not the author's opinion. The shortage in the crop and the consequent abandonment of holdings is in many cases due to the dearth of buffaloes, which renders the plough useless and necessitates the more strenuous method of cultivation by hand labour.

The native plough possesses the advantages of being light and of easy draught, a by no means unimportant item in this climate. It consists essentially of a short sharply turned mould-board which gives it great pulverising power and when properly used it is easier to manage and more efficient for the cultivation of a bindang than the more modern iron implement. The one great drawback is its shallow draught and the ease with which it comes out of the furrow and skins over the surface of the ground, but with a plough of this type it is not a difficult matter to go over the land a second time and pick out the unploughed portions.

With a view to subsoil cultivation and the production of a greater depth of puddle the author has had a subsoiler constructed by a local Chinese blacksmith which can be easily fixed in a few minutes to the wooden shaft of the native plough so as to follow along in the furrow made by the plough share. The Malays regarded it unfavourably at first and objected to it on the grounds that it would raise the sterile subsoil to the surface, which their own experience had taught them was bad practice. However when it was seen that it merely loosened the soil without raising it to the surface and that its cost was only $1-50 complete, they appeared much more interested in giving it a trial this year.

3. Concerning varieties.

The collection of varieties used in the above experiments consists of 8 Siamese, 5 Indian, 2 Japanese and 19 Malayan. With the exception of one Siamese variety (No 33) all the foreign varieties are much inferior in yield to the native varieties. From the standpoint of yield only, this country possesses varieties of rice that can hold their own with those of any country in the world. The average yield of padi in this country can be put at about 300 gantangs or 40 bushels per acre whilst yields of 600 to 900 gantangs or 80 to 120 bushels are not unknown. Below are given the yields of some of the chief rice growing countries of the world.

India	...	average yield	250	gantangs,	maximum	900	gantangs.
Burma	...	,,	200	,,			
British Guiana		,,	300	,,	,,	500	,,
Carolina (U.S.A.)		,,	500	,,	,,	1000	,,
Japan	...	,,	500	,,	,,	700	,,

With regard to quality of grain, the rices of this Peninsula are very inferior hence there is no sale for the native rice outside the states. Most of the varieties show considerable variation in the quality of the grain and observation of other characters such as height, tillering power and period of maturity point to the occurrence of

cross fertilisation and polymorphy as being fairly common among the numerous varieties to be found in any one district. This being so it augurs well for the success of selection experiments for the isolation of strains of superior merit and shows the difficulties that will arise in preserving the purity of these strains when once handed over to the natives. Seed selection experiments are now in progress at Kuala Kangsar with a view to improving the yield, milling qualities and purity of strain of several native varieties, but before any considerable improvement can be effected it will be necessary to conduct similar experiments at numerous centres throughout the country.

Before concluding this article it is my pleasant duty to express my indebtedness to Mr. H. B. Ellerton, District Officer, Kuala Kangsar for his untiring interest and the very generous assistance given to me in conducting the experiments in his district, without which these experiments could not have been sucessfully carried out nor the interest of the native cultivators roused.

PRELIMINARY NOTES ON TAPPING EXPERIMENTS AT KUALA LUMPUR.

Second Year Result.

By F. G. Spring.

The results of the first year's working of this experiment were published in September 1912, Vol. 1, No. 2 of the *Agricultural Bulletin, Federated Malay States.* It may be remembered that the experiment is divided into six different systems of tapping which are as follows.

Plot 1.

System of Tapping.—Quarter (Half Herring bone)
Two cuts 18 inches apart, Twenty cuts to the inch.
Every day Tapping.

Plot 2.

System of Tapping—Adjacent Quarters, Full Herring bone.
Two cuts 18 inches apart on each quarter. Twenty cuts to the inch.
Alternate day Tapping.

Plot 3.

System of Tapping—Single, V, 36 inches from base of tree. Twenty cuts to the inch.

Every day Tapping.

Plot 4.

System of Tapping—Double V, cuts 18 inches apart. Twenty cuts to the inch.

Alternate day Tapping.

Plot 5.

System of Tapping—Opposite Quarters. One cut of 36 inches on each quarter. Twenty cuts to the inch.

Every day Tapping.

Plot 6.

System of Tapping—Opposite Quarters. Two cuts of 18 inches apart on each quarter. Twenty cuts to the inch.

Alternate day Tapping.

In each plot tapping areas are so marked out that the circumference of each tree should be completely tapped in 4 years, thus allowing 4 years for bark renewal.

The number of trees in each plot is 65. Distance of planting 16 x 16 feet.

The average girths measured 3 feet from the ground in plots 1, 2, 3, 4, 5 and 6 at the beginning of the experiment were as follows:—20½, 20½, 21, 21⅕, 21⅗ and 21½ inches.

Before considering the results of the second year it would be as well to give the amounts of Latex Rubber, Scrap, Bark Shavings and total rubber obtained during the first year of tapping. These figures are as follows:—

	Plot 1. lbs. oz.	Plot 2. lbs. oz.	Plot 3. lbs. oz.	Plot 4. lbs. oz.	Plot 5. lbs oz.	Plot 6. lbs. oz.
Latex Rubber ...	125. 2½	99. 12	93. 13½	95. 13	90. 6	74. 6½
Scrap	20. 9½	13. 12½	20. 0	12. 6½	22. 11	16. 14½
Bark shavings ...	11. 13½	12. 3½	12. 4½	12. 15	15. 15½	15. 11
Total Rubber ...	157. 9½	125. 12	126. 2	121. 2½	129. ½	107. 0

In plots 1, 3 and 5, in which the trees were tapped every day, the results for the first year were not perhaps strictly comparable, because whereas in plot 1, the tapping cuts had extended at the end of the year's experiment to the base of the tree, in 3 and 5, the upper 18 inches only had been tapped, consequently in the two latter cases there remained an untapped area of bark at the base of the trees, which according to what is generally supposed give a bigger yield of latex than any other part of the trunk. It would be expected therefore that in the second year of tapping the V would have an advantage over the single quarter system as the cuts forming it are

18 inches from the ground at the commencement of the second year while in the case of the single quarter there are two superimposed cuts of 18 inches. The results clearly show this. During the first year the single quarter gave more total rubber than the V but the second year the V is far superior. Taking the period of the two years there is an excess of 48 lbs. total rubber in favour of the V and considering that the number of trees in each plot is only 65 the difference is a considerable one. In both plots (1 & 3) tapping is conducted every day so that the excess of 48 lbs. must be due to the system.

Another series of experiments being conducted at Kuala Lumpur, which will be published later, the V is also found to be superior to single or opposite quarters.

It is satisfactory that the results of a number of different series of experiments all point in the same direction. There may remain a doubt with regard to whether the V or half herring bone gives the largest yield of total rubber over a number of years but the writer is of opinion that the V will be proved, in the end, to be the best system. There is little doubt that opposite quarters gives far less rubber than either of the other two systems.

Comparing plots 3 & 4 where the V is adopted in both cases In number 3 there is one V tapped every day while in plot 4 there are two Vs tapped alternate days. Over the period of two years the every day tapping gives an excess of 63 lbs. more total rubber than alternate, which works out at 63 lbs. per acre per annum calculating 130 trees to the acre. In the case of old rubber a larger difference would in all probability be found in favour of every day tapping. It has already been found that doubling the number of cuts and converting every day tapping into alternate does not pay and it would appear also from the present experiment that less rubber is obtained from alternate day tapping where an equal amount of bark is removed in any time.

Judging from results at present being obtained, opening up young trees with a basal V has much to recommend it especially if this is continued the 2nd year by a basal V on the other side of the tree, and the 3rd year by a top V above the first basal V and the fourth year a top V opposite the V of the 3rd year. By adopting this method the V system of tapping is retained throughout.

Opposite quarters requires little consideration as there is nothing to recommend it. It will be seen by referring to the tables that the amount of total rubber is considerably lower than that obtained from the V or single quarter. That the V is superior to opposite quarters is further supported by results obtained at Gunong Angsi Experimental Plantation, an account of which was published in Vol. 1 No. 4 of the *Agricultural Bulletin Federated Malay States.*

SECOND YEAR RESULT.

	Plot 1.		Plot 2.		Plot 3.		Plot 4.		Plot 5.		Plot 6.	
	Latex Rubber lbs. oz.	Scrap lbs. oz.	Latex Rubber lbs. oz.	Scrap lbs. oz.	Latex Rubber lbs. oz.	Scrap lbs. oz.	Latex Rubber lbs. oz.	Scrap lbs. oz.	Latex Rubber lbs. oz.	Scrap lbs. oz.	Latex Rubber lbs. oz.	Scrap lbs. oz.
February 1912	12. 1	1. 10	8. 9½	1. 2½	14. 7½	1. 11	9. 3	0. 12	11. 1	1. 14	5. 14½	0. 15½
March ,,	10. 11½	2. 1	8. 11	0. 14½	14. 2	1. 12½	10. 3	1. 1	9. 12	1. 14	7. 1	1. 3
April ,,	10. 15	1. 7½	10. 9	1. 0	15. 4	1. 11	10. 11½	0. 15½	8. 6	1. 8	8. 12	1. 1½
May ,,	13. 12	1. 11½	13. 9	1. 7½	20. 13½	1. 14½	13. 14	0. 15	8. 4½	1. 10½	11. 3½	1. 6
June ,,	13. 7	1. 14	13. 4	1. 1	20. 3½	1. 9	14. 2	1. 5	12. 1	1. 7½	12. 1½	1. 2½
July ,,	17. 7	1. 10	17. 14½	1. 1	25. 0	1. 8	18. 11	1. 1	17. 6½	1. 8	13. 3	1. 1½
August ,,	16. 2	1. 11	23. 9½	1. 3	26. 6½	1. 8	24. 10½	1. 2	13. 9	1. 10	12. 4	1. 5
September ,,	16. 12½	2. 3	22. 13½	1. 7	26. 1	2. 7	24. 6	1. 6	11. 3	2. 3	9. 7½	1. 7
October ,,	19. 3½	1. 13	22. 8	1. 3	24. 13	1. 11	24. 10½	1. 2	10. 11½	1. 9	11. 13	1. 6½
November ,,	17. 5	1. 10	22. 8½	1. 3	25. 10	1. 2½	20. 7	0. 14	13. 8½	1. 8½	10. 12½	1. 10
December ,,	18. 4	1. 9	24. 2½	1. 1½	27. 10	1. 3½	21. 8	0. 13	21. 13	1. 6	15. 13	1. 6½
January 1913	16. 9½	1. 5	19. 2	0. 15	22. 6	1. 6	20. 9½	0. 10½	21. 12	1. 6½	12. 7½	1. 4
Total	182. 10	20. 9	207. 5	13. 11	262. 13	19. 8	213. 0	12. 1	159. 8	19. 9	130. 13	15. 5
Bark Shavings	11. 10		15. 7		12. 1		11. 8		12. 4		12. 10	
Scrap	20. 9		13. 11		19. 8		12. 1		19. 9		15. 5	
Total Rubber	214. 13		236. 7		294. 6		236. 9		191. 5		158. 12	

NOTES ON INSECTS PESTS.

By C. B. Holman Hunt.

Few Insects have been received this month but the following notes may be of interest.

Locusts.

Locusts have been reported from many places in Selangor, Negri Sembilan and Malacca.

The species has been identified as *Pachytylus danicus*, which is found in India in the higher grass lands and is known in Europe and Africa and has even been introduced into America.

In India it has not been very common up to date and it will be interesting to learn whether it has been increasing in numbers there during 1912. The type in India appears to be more green in colour than the local variety here which is of a reddish khaki hue. The young hopper is black, and when carefully examined, it is found to have a narrow tawny line on the vertex of the thorax.

This line increases in size and spreads over the whole surface till in the winged stage the locust varies from yellowish to reddish khaki with a long black patch on either side of the vertex of the thorax. At present the insect feeds in all stages chiefly on Lalang grass, but it has been found also attacking Coconuts and Padi.

The swarms can be driven away from any particular patch by coolies beating tomtoms or tins. Up to date, experiments with imported fungus pests have been a failure and poisoned baits seem to be the best way of getting rid of the pest.

But of course poisons have to be carefully guarded in this country.

Cutting deep trenches and lining them with tin may be useful for the hoppers, but these insects are very clever in breaking back through the line of beaters.

The eggs are laid in cylindrical masses about two inches deep in the ground. Ducks are voracious feeders on locusts.

Beetle Pest on Coconuts.

The Hispid Beetle mentioned recently as attacking coconuts near Singapore has been reported on young plants from Kuala Selangor. Cutting off and burning affected leaves or spraying them with Arsenical solution should do much to extirpate this pest.

Butterfly Pest on Coconuts.

This is *Hidari irava* and the larvae were common in February and March, but a large percentage were stung; an improvement suggested by Mr. Barritt on the box mentioned in the last number is

to cover it with mesh wide enough to let the Ichneumons emerge, but small enough to retain the caterpillars and resultant butterfly.

Cockchafers.

A large white Cockchafer or May-beetle, allied to *Tricholepis lactea* has been reported from Kedah doing damage in the grub stage to roots of Rubber seedlings. This grub usually feeds on roots of grasses and probably some of those have been left in the soil and the Rubber roots only attacked by accident.

Collecting the grubs and beetles for cash would probably do much to reduce the attack; but cases of its occurrence should be reported.

The grub is a creamy white, shiny, slightly hairy insect with the tail end of the body enlarged: the head with a pair of large jaws and the legs are yellowish brown and shiny.

It grows to about $2\frac{1}{2}$ inches. The beetle itself is about $1\frac{1}{2}$ inches long, snowy white with rather darker stripes along the wing cases.

ORNAMENTAL CLIMBING PLANTS.

Climbing plants are a very useful addition to every garden, whether large or small, as many unsightly parts of the garden may be made beautiful by the judicious use of these plants. They are most useful for covering unsightly tree stumps, walls, or fences, or for beautifying verandahs, small plant-houses, etc. Another use to which these plants may be put is the covering of unsightly banks that are too steep for turf to grow upon. If some free growing, climbing or trailing plants such as the "Honolulu" creeper (Antignon leptopis) and one or two of the Ipomoeas are planted at the top a little distance from the edge they will soon trail down over the bank and cover it with a carpet of foliage and flowers.

Climbing plants always look best when allowed to ramble at will over the object to be covered, and wherever possible they should be allowed to do so. Where climbers are placed to cover pergolas, arches over paths, or the fronts of verandahs it is necessary to keep them within bounds, in such cases pruning and training has to be resorted to.

Pruning when possible should be done after flowering but training will need constant attention as also will the thinning of shoots which are becoming crowded. Some plants require very little pruning while others are better if cut back periodically. Before commencing this operation note should be taken of the position of the flowers so as to preserve as much of that kind of wood as is necessary to produce a good crop of flowers next season. Some

plants bear their flowers on the old wood, others on lateral shoots from wood of the previous seasons growth, and others again bear them on the young shoots of the current seasons growth. Plants which flower on their old wood should have all superfluous growth cut out, also old exhausted stems; a few young shoots being taken up each time to replace old ones that have become exhausted through flowering. The majority flower either on the young growing shoot or on lateral branches from wood of the previous seasons growth. In the former case the shoots should be cut back to within a joint or two from their base and all old wood removed except that required to support the younger branches in the latter case the growths that have flowered should be cut out leaving young shoots for the next crop of flowers.

Climbers when trained often require tying to keep their shoots in position. In such cases the branches should be placed as naturally as possible, and where tying is necessary care should be taken not to tie too tightly or injury may result from the tying material cutting into the shoots.

Like many other plants climbers pay for planting in good soil, and for attention from time to time by stirring the soil about the roots, and adding stimulant as required. Before planting the soil should be well prepared and, if poor, manure should be added.

The methods of propagation are various but the majority may be grown fairly easily from cuttings, annuals and others that produce seeds freely may be propagated in that way providing they reproduce themselves true from seeds. Plants that do not produce seed and are difficult to grow from cuttings should be layered. This method of propagation is often successful and in some cases the only way the stock of plants can be increased. This operation is performed in the following manner:—An incision is made in the shoot to be layered with a sharp knife just below a joint, the knife being drawn upwards and inwards to the centre of the shoot and to just above the joint. This incision should be kept open by placing a small piece of stick or some sand in it. The shoot should then be pegged down and covered with sandy soil, which should be kept moist until roots are emitted, when the young plant may be severed from the parent and transplanted elsewhere. In cases where the shoot will not reach the ground a flowerpot may be fixed up, or earth may be bound round with coconut fibre and kept moist, either method will answer the purpose. In the latter case instead of cutting the shoot as for layering proper a ring of bark about a half an inch wide may be removed this method of propagation is termed "ringing."

The following is a list of climbers suitable for gardens in this country with a few notes on each. It should not be taken as a

complete list as there are many useful climbers beside those mentioned but this list gives a good selection of the commoner species and varieties that will grow well in this climate.

The following are woody climber.

Antignon leptopis, a slender stemmed Mexican climber, commonly known as the " Honolulu creeper " is one of the most useful and effective climbers we have. It is equally at home in any position producing its numerous racemes of pink or white flowers in great profusion. The inflorescences are rather peculiar growing out at the ends into branched tendrils which cling to objects with which it comes in contact support. These can be readily propagated from seed or cuttings.

Bignonia magnifica is a beautiful climber native of Columbia which produces large delicate mauve to rich purple coloured flowers with light primrose throats. These are produced in large branching panicles and with its broadly ovate leaves makes a very attractive climber worthy of a place in every garden.

Bignonia speciosa is a native of Uruguay and produces its flowers in terminal panicles the flowers being pink stained with purple. The Calyx in this case is spathaceous splitting on one side. The leaves are pinnate, truncate verticilate, and the leaflets oblong lanceolate, acuminate, shining and, serrate. There are several other species of Bignonia equally attractive and would I have no doubt do well in this climate. The two species above mentioned can be readily grown from cuttings.

Bongainvillea glabra native of Brazil is a very popular climber and does well in this country. Its beauty lies in its large rose coloured bracts which envelope the small greenish white flowers. The leaves are smooth cordate-ovate and the thorns which are a characteristic of these plants are hooked and very sharp which makes it a formidable plant to have dealings with. Its variety B. g. Sanderiana is a very floriferous variety with bracts of a rather richer colour.

B. speciosa also a native of Brazil is a very beautiful plant producing large cordate delicate lilac rose coloured bracts in immense panicles which in well grown specimens entirely shroud the whole plant. The leaves are dark green and covered with hairs on the upper surface. There are also two varieties of this species *viz* B. s. splendens and B. s. variegata. The former is a distinct variety having deep purplish mauve coloured bracts and the latter is a garden variety with variegated foliage.

B. spectabilis also a native of Brazil is very attractive on account of its brick red coloured bracts shaded with scarlet, the great drawback to this plant however is its shyness in flowering. B. spectabilis variety laterita has brick red bracts. This plant is also

somewhat sparing with its flowers : growth also is not so free as in most Bongainvilleas. These plants may all be increased by cuttings of well ripened young shoots.

Camœnsia maxima native of Tropical Africa is a handsome quick growing climber. It is probably the largest flowered leguminous plant known bearing flowers as it does from nine inches to a foot in length. The flowers are creamy white in colour and are borne in short axilary racemes. This plant thrives well when planted in a rich loamy soil and looks well trained over arches or pergolas. It is naturally a quick grower and requires to be cut back to induce it to flower freely. This plant unfortunately is difficult to propagate and is therefore scarce in this part of the world. I have been told that it can be propagated by well ripened short lateral shoots taken off with a heel of old wood but whether this is so or not I cannot say as I have never succeeded in propagating it myself.

Congea tomentosa a native of Burma deserves a place in every garden on account of its long sprays of inflorescence which remains bright and unfaded for several weeks. Like several other well known favourites the showy part consists not of flowers but of bright coloured bracts subtending the flowers. At first the bracts are a delicate pink shade gradually merging into lighter tints of pleasing contrast as they get older. It grows quite freely from cuttings if they are placed in a moist shady position in sandy soil.

Clerodendron scandens is a useful plant for training on fences or trellises. Its leaves are cordate-ovate, acuminate, entire, and downy and the flowers are white, produced in corymbs along the current years growth. This plant should occasionally have the old wood pruned out and the young growths encouraged.

C. Splendens a native of Tropical Africa is a very pretty climber with scarlet flowers borne in terminal corymbose panicles which are very effective. In other respects it is similar to C. scandens.

C. Thomsonae is also a native of Tropical Africa and is the most handsome climber of the genus. The flowers are bright crimson surrounded by pure white bracts borne in terminal panicles on young lateral branches from the previous year growth. All the clerodendrons can be propagated either from seeds or cuttings.

Hoya carnosa a native of Qeensland is well worth cultivating on account of its small pinkish white, waxy, and sweet scented flowers which are borne in pendulous umbels in the axils of the leaves. This plant is best increased by layering.

Odontodenia speciosa, or Dipladenia Harrisii as it more commonly known, is a native of the W. Indies and is one of the handsomest climbers I know. It is most deserving of cultivation on account of its large dark green leaves and large funnel-shaped sweet

scented yellow flowers shaded with orange. This plant requires plenty of room to grow as its shoots will often grow to 20 or 30 feet in length or even more. Unfortunately this plant is not easy to propagate by cuttings and seeds are never produced in this country. With a little care cuttings will occasionally strike if placed in light sandy soil. Young shoots taken with a slight heel of old wood are best. It may also be propagated by layering.

Porania volubilis commonly known as "Bridal Creeper" is a pretty Indian climber with a good habit and vigorous constitution well suited for training over verandahs, pillars, etc. The flowers are small, white, and produced in dense panicles of pendulous habit which makes it most effective. This plant can also be propagated by cuttings.

Tecoma grandiflora is a native of China and produces trumpet-shaped flowers in terminal panicles. T. amboinensis a native of Amboyna is another species worthy of cultivation on account of its orange red flowers 3-4 inches in length borne in axilary racemes. T. jasminoides is an Australian climber with white flowers streaked with red in the throat. These are commonly known as "Trumpet Creepers" and are all well worth cultivating for their beautiful trumpet shaped flowers. These may be propagated by root cuttings or by layers.

Stephanotis floribunda a native of Madagascar is a most beautiful and popular plant on account of its fragrant, pure white, waxy flower which are borne in clusters in the axils of the leaves. This plant is popularly known as the "Cluster Wax Flower" or Madagascar Jasmine and thrives well when planted in wooden tubs and trained over a trellis in a rather shaded position, cuttings of young shoots taken with a heel of old wood root readily in sandy soil.

Stigmaphyllon ciliatum the "Golden Vine" native of Brazil is a pretty climber worthy of a place in every garden on account of its large golden yellow flowers which are borne in umbels from the axils of the leaves. This plant can be propagated by cuttings.

Tristellateia australasica is a very useful climber for covering unsightly stumps of trees or other object, as it is a free grower and when in flower makes a good show of yellow flowers, which are borne in simple racemes terminating the short lateral branches. The leaves are opposite, petiolate, ovate, entire, acute, smooth and dark green. Being evergreen the plant makes a good covering if allowed to grow at will and whether in flower or not it is never unsightly.

(To be continued).

PLANTING PARA RUBBER ON HILL SIDES.

By L. C. Brown.

In planting Para Rubber on the side of hills where the gradients are severe, I believe it would prove of great advantage to adopt the same method as that practised in Penang with Nutmegs and Cloves on similar situations.

The system is simple enough. As soon as the young plants or stumps have been put out, a circle of about 3 feet in diameter is made round them and the earth taken from the upper half of this to the lower so as to form the circle into a terrace. At each weeding after this, more earth should be taken from above the plant and the circle enlarged and weeded. If this be done constantly as the coolies come round at the regular weeding periods it will be found that by the time the trees have reached maturity these circles practically form a series of terraces on the sides of the hills, according to the distances the trees are apart.

It will be noticed that the plants are all along being fed with the rich surface soil which alone should assist their growth and for the same reason the circles or terraces round the trees are easily weeded and kept clean as the top surface soil remains loose and friable for a considerable time. Apart from the entire eradication of lalang, no other weeding on the clearing is required and the timber and grass will prevent heavy wash and quite do away with the necessity of drainage, of course the timber and stumps should ultimately all be removed and destroyed. The next benefit derived is when the tapping stage commences; for instead of the tappers having the difficulty of climbing slopes in an irregular way, they each take a circle or circles as the case may be, the walking being practically all on the level, and under these conditions the coolies should be able to tap the same, or if not very nearly the same number of trees as on the flat.

Considering the saving of expense that can be effected in the directions I have mentioned, the system should not be unduly costly and I think on the other hand it must be admitted it has many advantages over the method now usually adopted. I may in conclusion mention that this method of cultivation must be commenced while the plants are quite young, otherwise taking the earth from above the trees when once thoroughly established would mean the lateral roots being interfered with and exposed.

RICE CULTURE IN JAVA.

Review.

There has recently appeared in *Der Tropenpflanzer* a monograph by a German scientist, Dr. S. V. Simon, giving, as the outcome of

a prolonged study, a very detailed description of the best methods of rice cultivation practised in Java to-day.*

As they are carried out under conditions of irrigation, etc., superior to those that exist in this country, and not only have behind them the accumulated experience of centuries but admit of scientific explanation and justification also, it is hoped that the following account, prepared from Dr. Simon's paper, may be of interest.

In justice to Dr. Simon, it should be explained that what follows is not more than an abstract of his paper. Many sections of scientific and practical importance, dealing with pests, disease, investigations on irrigation, water, etc. have been entirely omitted, as also has much that goes to present to the Western reader a vivid picture of the staple cultivation of the East.

The method of cultivation to be described represents that in vogue on irrigated land, where the cultivator therefore has proper control over the conditions of work.

Cultivation of the Sawah.

Some time before the commencement of work on the fields themselves the water channels are carefully cleaned out from weeds and silt, the dams and battis repaired and the bamboo pipes that lead the water from one sawah to another examined and when necessary replaced.

As yet no rational manuring system is carried out, but it is usual to return to the land the ashes from the straw of the previous crop. These are now broadcast over the field, the weeds cut and the water turned on for the wetting preliminary to the first ploughing. A continuous flow, which, according to the nature and permeability of the soil may last from 1-2 weeks, is always arranged for, this being advantageous for the quick oxidation and decomposition of vegetable matter.

For the first working the water is run off to a large extent and the ground ploughed from sides to centre in a constantly diminishing spiral. The earth by this is thrown up in large clods and at this stage is not further "fined." Ploughing completed the water is again turned on and flows through for 8-10 days after which comes the second ploughing.

This flooding carries forward to a further stage and to a greater depth the oxidation of the decomposing organic matter, rendering its nitrogen and mineral salts available as food for the coming crop.

The second and final ploughing is carried out diagonally to the first—the water having again been largely removed. Then follows a further flooding of a weeks duration, softening the clods and com-

*Studien über den Reisbau auf Java by Dr. S, V. Simon *Der Tropenflanger* 1912 No, 9,10,11, & 12,

pleting the oxidation processes, after which, without this time ruuning off the water, the ground is harrowed down to a mushy consistency,—once or twice usually sufficing.

Finally it is carefully levelled with a heavy plank, so that the water shall not be deeper in one place than in another, and is then ready to receive the young plants.

The Seed-bed.

For the seed beds land that is most easily irrigated is chosen and preferably soil of rather less than the average fertility, experience having shewn that rice plants reared on very good land develop more slowly after transplanting than if from a less fertile soil.

The seed beds are prepared in the same way as the sawah, with the difference that the intervals between the various operations are reduced to the minimum, the whole series being completed in about 7 days.

This treatment, as might be expected, is not good for the land, and the beds are not made in the same place for two consecutive seasons. They are usually 3-4 feet in width, and the channels between them 1-2 feet wide and ½-1 foot deep.

From the day previous to the seeding no more water is added.

Seeding-out.

In former times almost without exception the whole ears of padi were planted, in rows on the surface, without the grain being separated, the advantage being that in case of heavy rains and the coming down of too strong a current of water the young plants could not get washed about.

On the other hand seed selection was prevented and subsequent selecting out of the plants rendered difficult, so the method has been abandoned, single grains being now invariably sown.

Grain from the previous harvest is thrown into water, those that float being rejected. The others are put into bamboo baskets and placed in running water for 2-3 days, until they are soaked through and commencing to germinate. The water is then allowed to drain away for several hours, some ashes are mixed in to render the seeds less liable to adhere together and they are then planted.

Roughly speaking 1 lb. of wet seed plants 6½ square yards of the seed bed and 40-50 lbs. suffices for each acre of the sawah. Concerning the amount of water to be added to the seed bed different views are held. Formerly a depth of several centimetres was used but the more general practice now is to employ only sufficient to fill the channels between the beds, reaching just to the surface.

After the sowing of the seed the seedlings are ready for the sawah in 30-40 days, and are not previously transplanted as in Krian,

Dry seed-beds.

Important advantages are attached to the use of dry seed-beds, to which, failing rain, moisture only just sufficient for the maintenance of growth is added, and in which the plants remain for about 100 days before being transplanted.

In districts dependent entirely on the rainfall it often happens that the seedlings are delayed in the nurseries before planting out is possible. When this is so they rapidly become weakened and diseased, owing to their quick development in a limited space. In a dry seed bed, on the other hand, growth is so much slower that a delay of as long as a month is without ill effect. Furthermore whereas seedlings from a wet seed-bed require about 14 days to become established and take up their growth after transplanting, those from the dry seed-bed take only 3-7 days, and are therefore less liable to attack by disease and pests.

They also "tiller," *i.e.* throw up new shoots, better than if from a wet seed-bed.

The present writer can testify that this method of dry planting is in great favor amongst the Dutch agricultural instructors, and that every effort is being made to bring it into general use.

To avoid injuring to the seedlings the dry beds have to be thoroughly soaked with water just before planting-out time, until soft enough for the plants to be removed without harming the roots.

The Sawah.

The seedlings are transported in bundles to the sawah and their stems cut down to a third, such plants as appear weak or diseased being of course rejected.

According to their strength two or at most four are put into a single hole being pressed down by finger and thumb, and are inclined slightly towards the direction of the water flow. The planting distance depends on the "tillering" usually developed under the particular conditions of soil, climate and variety of padi. If these are favorable the distance is 25-30 centimetres, under poorer ones 15-20 cms. During the first two weeks after planting, that is until the plants take up their growth, water is added very frugally, beginning only when the surface commences to dry. After 15-20 days the full supply can usually be employed and very soon the first weeding must be undertaken.

This is done with very little water on the land. The weeds are pulled up and thrown on the surface and the ground worked through with the fingers, with as much care as possible for the roots of the young rice plants.

By this means the hard crust often formed by the first action of the water is broken up a few days after planting. The weeds serve as a green manure.

At this period also the weaker plants are removed and replaced by fresh, from reserves kept for the purpose.

Under the continnous water supply, the height of the water layer is best about 10 centimetres, the main phase of the plant's development sets in, during which many new shoots spring up.

After six weeks a second and final weeding is carried out, two days before it the water supply being cut off.

This time of course serious disturbance of the ground is out of the question on account of the extent of the root system. The weeds are carefully pulled up, the young, fleshy, and easily decomposed ones being laid between the rows of padi whilst the grasses and tougher plants are placed on the dams to rot, to be ploughed under for the next crop. To prevent a further development of those left lying on the fields no more water is added for several days, after which it is turned on again and continued in full flow until the first formation of the flower.

Then it is gradually diminished, being finally stopped when the fruit has attained full growth and begins to lose its green colour.

The harvesting is carried out as in Malaya and need not be described here.

On the artificially irrigated lands, after an interval of a month during which the padi is dried and stored, the fields are flooded afresh and the cultivation for the next crop started.

With padis of short life cycle two crops a year can be obtained, this being the maximum. Varieties having a longer life cycle however afford rice of better quality and the general practice is to get three crops in two years.

The following table shews the variations in the periods taken.

	Life cycle of variety.	
	minimum	maximum
Preparation of Sawah	1½-2 months	1½-2 months
Planting out to reaping	4 „	5½-6 „
Interval to recommencement	1 „	1 „
	6½-7 months	8-9 months

On the land directly dependent for its water on the rainfall, where several months have to elapse before the rice crop can be sown again it is usual either to graze cattle or to plant a "second" crop, necessarily one having a short duration.

The choice depends largely on the moisture content of the ground during the dry season, also on local requirements, these second crops being practically entirely consumed by the population,

although under other circumstances many of them would equally well serve for export.

Of these the most important are maize, the earth-nut, (*Arachis hypogoea,*) soy beans and many other legumes, capsicum, tubers (spp. ipomoea and dioscorea), sorghum and tobacco.

In addition to the increased annual return per acre this practice of dry cultivating the soil and having a rotation of crops—particularly when these are leguminous—cannot fail to have a most beneficial effect on the soil and on its annual yield of padi.

On the other hand where through any reason a padi field remains under stagnant water for any length of time a very bad effect is produced. Marsh plants soon spring up and probably bacterial action sets in resulting in loss of nitrogen that would otherwise become oxidised and available for the nutrition of the next crop to be grown.

Amongst the rice producing countries of South-East Asia Java occupies a prominent position. Although the amount exported is so small as to be almost without significance in the world-market—owing to the growing needs of a dense and steadily increasing population—the statistics shew an annual production of no less than 5,200,000 tons. Of this only 54,000 tons are exported, of a rice of very high quality, and this is more than counterbalanced by an annual import of 216,000 tons, mainly of inferior grades.

The land on which this enormous crop is produced has an area of about 6 million acres, of which more than 3½ million are artificially irrigated, either by the natives themselves or by Government.

The population being 30 millions it is thus seen that on an average each acre is made to produce sufficient for the support of 5 persons, a striking testimony to the efficiency of the cultivation.

The culture is carried out not only on the great plains of the East, some districts of which, being very rich in phosphates, give very high yields, but also on the highly laterised upland soils of West Java, to a height of 1,000 to 1,200 metres. Here, where the padi land is all artificially irrigated and the rainfall evenly distributed cultivation is continuous the year round, but in the East a fairly pronounced dry season may be expected from May to August and procedure has to be regulated accordingly.

Varieties.

Although the quantity of rice exported from Java is small, it is of very good quality and realises high prices.

As yet the best export rice is one originally imported from Carolina. A pure line isolated from this at the Experiment-Station Tjikomoh, Buitenzorg, sold (Batavia, 1910) for $7.50 per picul, but

the yield on the Buitenzorg soil was not very high. The crop however produced $98.50 per acre.

Another good export rice was bred out of a native variety from the Sourabaya district. The quality is not equal to that of the Carolina rice but the yield is much higher, making it the most profitable of all to cultivate. The return per acre amounted to $106.90.

Converted into our terms, the yield in this case corresponded to about 400 *gantangs* per acre. This seems low compared with the 600, 800 and even 1,000 *gantangs* yielded by some of the best alluvial soils in Malaya, but it should be remembered that the soil at Buitenzorg and throughout the Preanger is a laterite of by no means high fertility.

Though the kindness of Dr. Van der Stok, chief of the Experiment-Station, the present writer was recently enable to bring away a number of the best varieties produced at Tjikomoh, and it will be interesting to see how they fare in this country.

M. B.

HOW TO DISTINGUISH DIFFERENT ORDERS OF INSECTS IN THEIR VARIOUS STAGES.

Lepidoptera.

By C. B. Holman Hunt.

Lepidoptera are insects with two pairs of wings covered with scales and include the Butterflies and Moths.

Butterflies are distinguished from Moths by the combined difference in the antennae which are knobbed in the former and not knobbed in the latter and the absence of the Frenulum or hook, which in many Moths holds the hind wing to the fore wing at the base.

Some Moths have no frenulum and others have knobbed antennae, but no Moths, in this region at any rate, have knobbed antennae and no frenulum. All Lepidoptera undergo a complete metamorphosis.

The Butterflies are divided into

(i) the Papilionina with slender bodies and large wings.

(ii) The Hesperiina with stout bodies and small wings. These are the connecting links with the Moths.

For those who have the time to spare it will be interesting to denude the wings of the scales and study the arrangement of the veins or tubes in the wings, which is the basis of the classification of the different families in both the Moths and the Butterflies.

The Butterflies are further divided according to the structure of the forelegs which may be almost aborted in both sexes, almost aborted in the male or completely developed.

Those who wish to collect Butterflies would do well to get a copy of Distant's "Rhopalocera Malayana" which has coloured plates of almost all the local species and good simple descriptions of them; the price is about $50/- secondhand.

For those who want a more technical and less complete book of local species up to the Hesperiina, Col. Bingham's book, "The Butterflies of India, Burmah and Ceylon" in two volumes at about 20s per volume may be recommended. Distant's book describes 503 species, althougth it was only published in 1886 and some more species have been added to the known fauna since then.

The most important pests among the Butterflies are found among the Hesperiina, which often do damage to Coconuts, Plantains and Padi.

Among the Papilionina the Satyridae do damage in the caterpillar state to grasses and Padi, while some of the Lycaenid caterpillars feed on Pomegranates and other fruits.

Generally speaking caterpillars found feeding on one plant will not feed on plants of other kinds, though they may be induced to feed on allied species of leaves.

A Butterfly consists of:

I. The head bearing externally the mouth parts, eyes and antennae.
II. The thorax bearing the wings and legs.
III. The abdomen without external processes.

The mouth parts consist principally of an upper lip, a pair of maxillae lengthened out into a tube, when joined together but separable at will and a lower lip with small jointed palps or brushes one on each side: some lower type moths have rudimentary mandibles and also jointed palps or small feelers on the Maxillae.

The eyes are compound with a large number of facets and in some groups there are also simple one-lensed eyes near the compound ones.

The antennae, as I have said before, are knobbed in the butterflies and variously formed in the Moths. They are probably organs of hearing and possibly of smell.

It is not impossible that they are even organs of a sense which we do not possess.

The Moths which have the antennae best developed with much feathery branching possess the power of "sembling."

A female Moth put out in a cage will attract males from miles around. This is called "Sembling."

Butterflies deprived of one or both antennae lose their sense of direction.

The legs will be found to consist of a number of joints of which that nearest the body is known as the Coxa. Jointed to this is the

Femur, then comes the Tibia and then the generally five jointed Tarsus; between the Coxa and Femur is a shield-like cover to the soft tendon, called the Trochanter.

The Tibiae may be spurred with one or two paired spurs behind in the middle and at the heel, or they may be spined with rows of of spines in front or at the sides.

The wings are four in number, one pair of forewings and one of hindwings; they are covered with scales overlapping like slates and filled with a colouring matter which is probably a biliary product.

They are traversed by tubes, the arrangement of which is used for determining the species.

When the Moth or Butterfly emerges from the pupa the wings are soft and small, but air is pumped into the tubes which makes the wings enlarge and spread out and they soon harden. There are generally twelve main tubes in the forewing and eight in the hindwing.

The abdomen consists normally of 9 or 10 segments but some of them may be aborted. Along the sides of the abdomen and on the first segment of the thorax, which consists of three segments, lies a paired row of spiracles through which the insect breathes.

A few Lepidoptera are apparently apterous.

The female Lepidopteron lays a number of eggs singly or in batches usually on the under side of the leaves, on which the future larvae are to feed.

The larvae hatch out after a few weeks and are very small on emergence, but they grow rapidly, casting their skin at intervals.

They may vary much in shape according to the species, being usually cylindrical, with or without hairs or spines, but they may be globular, semiglobular or even fantastically formed.

They consist of 13 (or perhaps 14) segments including the head, which is provided with biting jaws and various appendages including spinnerets and small simple eyes. The next three segments, named Thoracic, carry three pairs of true jointed legs and a pair of spiracles on the first segment, the remaining segments are Abdominal and carry a pair of spiracles to each segment, arranged laterally and also a varying number of paired prolegs, terminating in a pad surrounded by claws. The Butterflies and some large groups of Moths have 5 pairs of prolegs, but the Geometridae have only two pairs.

When full grown the pupa is formed under the skin, which dries and is cast off, and the pupa, usually of conical shape with all the chief external organs mapped out on the surface, either is suspended by the tail, by the tail and a central belt, or is packed away with or without a cocoon under the ground, on the bark of a tree or between leaves or even in a tunnel bored by a larva.

The insect remains in this state for some months and then bursts the pupa skin and when enclosed in a cocoon is provided with a fluid which dissolves the silk and it emerges very soft and with the wings very small, but the scales soon harden, the wings enlarge and the Lepidopteron is ready for its first flight.

Of course if the larva has been stung by an Ichneumon the imago or winged insect does not come out and comparatively few moths result from a large batch of eggs.

Where a Moth is a pest, the larvae should be collected and fed up in boxes provided with mesh large enough to let the parasite out but to retain the moth.

The principal Moth pests in the caterpillar stage are.

I. The Psychidae which enclose themselves in a case of fragments of leaf; a serious Coconut pest belongs to this group.

II. The stem boring Noctuids which attack Padi.

III. The Atlas Moths which attack Camphor and Guava and defoliate the trees when in numbers.

IV. Various species of the Pyralidae which spin leaves together and feed on them. These often start a fungus pest which attacks other leaves.

DEPARTMENTAL NOTES.

Mr. B. J. Eaton, Agricultural Chemist, Department of Agriculture, F.M.S., arrived at Kuala Lumpur, on return from leave, and assumed his duties on March 15th.

Mr. J. G. Watson, Assistant Superintendent of Government Plantations, Selangor and Negri Sembilan, Department of Agriculture, F.M.S., arrived at Kuala Lumpur and assumed his duties on March 20th.

NOTES ON THE SINGAPORE MARKET FOR STRAITS PRODUCE DURING MARCH, 1913.

A considerable decline has taken place in the value of most articles, and demand generally is even quieter than during the previous month.

Black Pepper.—Large arrivals of Johore Pepper on a dull market brought about a sharp decline, and business was done as low as $17, with a return to rather better prices towards the end of the month, which however did not continue, and the month closed with buyers at $16½, sellers $17¼.

White Pepper.—Supplies were almost entirely of inferior quality, and the price declined to $32 to $32½.

Gambier.—Although supplies were not excessive, buyers have been scarce, and a further decline has taken place, closing quotation being $7¼ for fair quality.

Cube Gambier.—This article has been almost entirely neglected, and is now offered freely at $11 for No. 1 and $10 for No. 2 without finding buyers.

Copra.—Arrivals have been small, and with an excellent demand from all quarters, prices have steadily moved upwards, closing quotations being

Bally	$12-80
Kayong	$12-60
Pulo	$12-20
Siantan	$12-20

Rubber.—has gone easier and the market has been very dull. Closing values are

Fine Pale Crepe	$195.
No. 2 Crepe	$180.
Smoked Sheet	$188.
Unsmoked Sheet	$181.
Scrap Sheet	$130/140.

Tapioca.—Has declined and the market dull at $6-80 and $6-25 for Flake and Pearl respectively.

Nutmegs.—Are easier with only small business transacted.

Sago Flour.—Owing to supplies coming in more freely prices are some what easier. Closing prices are $3-65/$3-50 according to quality.

FEDERATED MALAY STATES.

Comparative Statement of Cultivated Rubber Exported during the Years 1913 and 1912.

Produced in	Exported during Feb., 1913	Previously.	Total export during the year 1913.	Export during similar period of previous year.	Increase.
	lbs.	lbs.	lbs.	lbs.	lbs.
Perak	1,196,143	1,236,298	2,432,441	1,601,507	830,934
Selangor	1,995,647	2,620,176	4,615,823	2,753,998	1,861,855
Negri Sembilan	741,508	900,129	1,641,637	1,076,287	565,350
Pahang	3,231	16,277	19,508	14,581	4,927
Total ...	3,936,529	4,772,880	8,709,409	5,446,343	3,263,066

Exported via	To United Kingdom.		To Continent of Europe.		To Ceylon.		To America.		Total.	
	Feb.	To date.	Feb.	To date.	Feb.	To date.	Feb.	To date.	Feb.	To date
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Port Swettenham	1,856,219	4,395,682	245,447	571,380	114,574	297,681	...	...	2,216,240	5,264,743

NOTE.—America, Australia, and Japan nil.

KUALA LUMPUR,
12th March, 1913.

W. J. P. HUME,
Commissioner, Trade and Customs, F.M.S.

FEDERATED MALAY STATES.

AMENDED Comparative Statement of Cultivated Rubber Exported during the Years 1913 and 1912.

Produced in	Exported during Jan., 1913.	Previously.	Total export during the year 1913.	Export during similar period of previous year.	Increase
	lbs.	lbs.	lbs.	lbs.	lbs.
Perak	1,236,298	...	1,236,298	823,243	413,055
Selangor	2,620,176	...	2,620,176	1,352,473	1,267,703
Negri Sembilan	900,129	...	900,129	551,029	349,100
Pahang	16,277	...	16,277	3,831	12,446
Total ...	4,772,880	...	4,772,880	2,730,576	2,042,304

Exported viâ	To United Kingdom.		To Continent of Europe		To Ceylon.		To America.		Total	
	Jan.	To date	Jan.	To date.	Jan.	To date.	Jan.	To date.	Jan.	To date.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Port Swettenham	2,539,463	...	325,933	...	183,107	...	...	...	3,048,503	...

KUALA LUMPUR,
21st February, 1913.

W. J. P. HUME,
Commissioner, Trade and Customs, F.M.S.

ERRATUM.

In the return of Rubber exported from Perak the following amounts were omitted October, 4,400 lbs., making the total export for Perak 1,043,389 lbs. and that for the Federated Malay States 3,215,231 lbs.; and November, 10,000 lbs., making the total export for Perak 954,709 lbs. and that for the Federated Malay States 3,121,473 lbs.

The following is a corrected statement for the year 1912 and includes the above omissions.

Produced in	Exported during Dec., 1912.	Previously.	Total export during the year.	Export during similar period of previous year.	Increase
	lbs.	lbs.	lbs.	lbs.	lbs.
Perak	1,177,672	9,307,017	10,484,689	5,553,277	4,931,412
Selangor	1,783.249	16,116,889	17,900,138	10,487,916	7,412,222
Negri Sembilan	721,015	5,509,808	6,230,823	3,615,174	2,615,649
Pahang	11,993	104,772	116,765	38,963	77,802
Total ...	3,693,929	31,038,486	34,732,415	19,695,330	15,037,085

Exported via	To United Kingdom.		To Continent of Europe		To Ceylon.		To America.		Total.	
	Dec.	To date	Dec.	To date	Dec.	To date	Dec.	To date	Dec.	To date.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Port Swettenham	1,557,148	16,725,646	202,071	2,306,584	107,307	902,442	...	23,413	1,866,526	19,958,085

Note.—To Australia and Japan nil.

KUALA LUMPUR,
21st February, 1913.

W. J. P. HUME,
Commissioner, Trade and Customs, F.M.S.

Abstract of Meteorological Readings in the various Districts of Malaya for the Month of February, 1913.

DISTRICT.	Mean Barometrical Pressure at 32° Fah.	Maximum in Sun.	TEMPERATURE.				HYGROMETER.				Prevailing Direction of Winds.	Total Rainfall.	Greatest Rainfall during 24 hours.
			Mean Dry Bulb.	Maximum.	Minimum.	Range.	Mean Wet Bulb.	Vapour Tension.	Dew Point.	Humidity.			
Kelantan, Khota Bahru	...	144.0	79.3	84.17	72.85	11.32	76.0	.832	73.7	83.0	...	1.26	.51
Malacca, Durian Daun Hos.	29.900	151.8	82.0	89.04	72.	17.04	72.2	.870	...	81.	N.	3.89	1.59
N. Sembilan, Dist. Hospital Seremban	...	147.7	80.4	90.3	71.8	18.5	75.2	.782	71.8	74.	N.	3.28	1.22
,, Dist. Hos. K. Pilah	...	157.3	80.5	89.8	70.1	19.7	77.2	.863	74.7	82.	...	2.04	0.67
,, ,, Tampin	...	150.4	79.9	86.9	73.6	13.3	73.5	.719	69.3	71.	...	1.78	0.85
,, ,, P. Dickson	...	158.7	82.2	88 5	73.7	14.8	76.3	.799	72.4	72.	...	3.01	1.52
Pahang, ,, K. Lipis	...	...	79.4	87.5	67.1	20.4	73.6	...	...	...	...	3.11	1.11
Penang, ,, Penang	29.830	157.5	84.6	95.5	72.0	23.5	76.4	.797	71.3	68.	...	1.18	.78
Perak, ,, Taiping	...	108	82.08	94.	69.	25.	76.96	.857	...	78.	...	9.99	2.52
,, ,, Ipoh	...	...	82.51	93.	70.	23.	75.87	.805	...	73.	...	5.35	1.55
,, ,, T. Anson	...	...	81.73	93.	69.	24.	77.44	.885	...	83.	...	8.10	1.86
,, ,, P. Buntar	...	...	82.62	92.	69.	23.	76.88	.847	...	77.	...	2.57	.90
,, The Cottage	...	...	...	...	...	...	...	...	...	...	...	3.85	1.05
Selangor, General Hospital Kuala Lumpur	...	149.7	82.6	87.8	72.6	15.2	76.6	.806	72.6	72.	...	3.72	1.36
,, Dist. Hos. Klang	...	...	...	88.1	64.7	23.4	...	...	...	...	...	8.10	2.82
,, ,, K. Selangor	...	...	...	89.2	69.1	20.1	...	...	...	...	...	5.71	1.51
,, ,, Rawang	...	...	...	91.1	70.9	20.2	...	...	...	...	...	5.43	1.86
Singapore, Kandang Kerbau Observatory	29.908	162.0	81.5	93.8	71.0	22.8	76.2	.838	...	79.	N. E.	9.25	2.53